

PROBLEMS AFFECTING THE ECOLOGY OF ISLANDS IN THE WEST GIPPSLAND REGION

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INTRODUCTION

The islands of Bass Strait and most of the West Gippsland islands lie on the shallow continental shelf joining Tasmania with the Australian mainland. The isolation of the islands is of geologically recent age and Littlejohn and Martin (1965), in a discussion of the affinities of Bass Strait amphibia, considered that the present coastline originated about 6,000 years B.P. Since that time the islands' ecosystems have evolved, only to undergo considerable modification following the advent of European man.

The recent 'Military Survey' map (1:250,000, C.W. Govt. Print., Canberra 1968) of the Victorian coastline names 33 islands and locates a further six. These have an approximate total surface area of 95,000 acres (38,300 hectares). Of these islands 30 (77%) occur along the West Gippsland coast, having a total surface area of about 86,000 acres (i.e. 90% of the total) and a further four are recorded as exposed banks. This paper reviews such ecological data as exist concerning the West Gippsland islands. Where possible, changes known to have occurred on the islands are described and problems peculiar to these islands are noted in a consideration of their importance as conservation units. Whilst the discussion is restricted to the West Gippsland islands, remarks apply also to other Bass Strait islands (included in Tasmanian boundaries S. of 39°12'S.) with which they form an entity.

Fig. 1 shows the location of West Gippsland islands mentioned in the text.

ISLANDS OF THE WEST GIPPSLAND COAST

1. QUAIL ISLAND 37°14'S. 145°17'E.

A low-lying scrub-covered island about two miles long and one and a half miles wide, Quail

Island lies close to the northwestern edge of Westernport Bay (Ports and Harbours, 1959). The island of c.2,000 acres was declared a sanctuary for native game in March 1928 (and gazetted as a State Game Reserve in 1960). Since then a large population of koalas (*Phascolarctos cinereus*) originating from releases of animals from French Island (165 were released during the 1929-1933 period), has given rise to occasional concern. In November 1943 denuded eucalypts were thought to indicate an over-populated area and the press encouraged the topic (e.g. Melbourne *Herald*, November 6 and December 1, 1943). Subsequently operations by the then Fisheries and Game Department reduced the population and 1,250 of these koalas were released elsewhere in Victoria.

Occasional fires, caused by lightning, or more probably, by man, present to the island a major problem which may increase with the development of the Westernport area.

2. CHINAMANS ISLAND 37°14'S. 145°18'E.

A small mangrove-fringed island occupying about 150 acres; the area was reserved in 1958 for wildlife generally and for koala in particular.

3. FRENCH ISLAND 37°29'S. 145°23'E.

French Island lies across the middle of Westernport Bay, extends eleven miles eastward, and is eight miles wide with the highest point Mount Wellington, 314 ft (95.7m). The island occupies 42,000 acres (16,900 hectares) and has a main ridge two miles wide. This is heavily timbered with manna gum (*Eucalyptus viminalis*) and white gum (*E. rossii*) (Ports and Harbours, 1959). The manna gum was previously more extensive and the stand supported a large population of koalas originating from releases around the turn of the century (McNally, 1957). Between 1928 and

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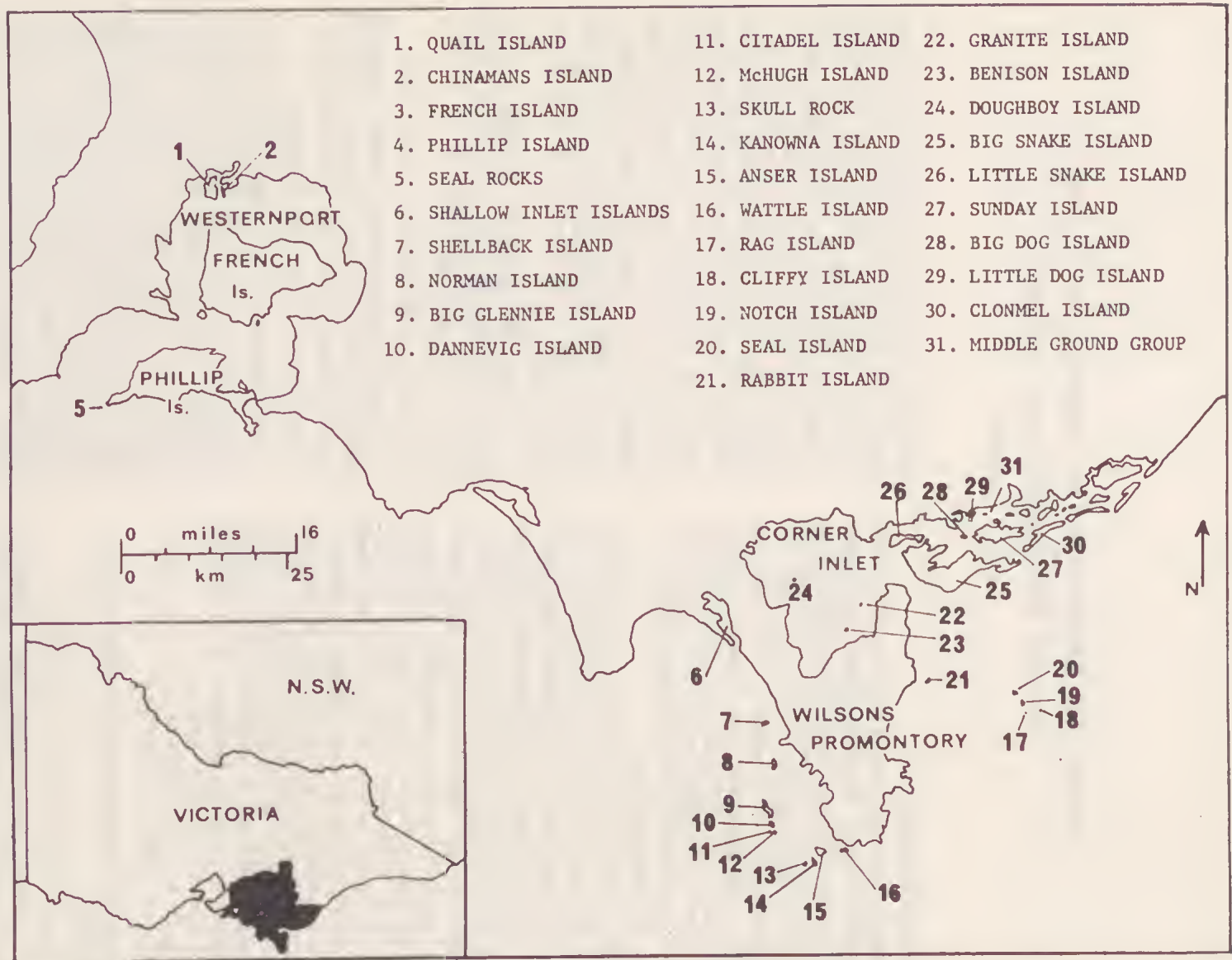


FIG. 1—Islands of the West Gippsland Region.

1940 some of these koalas were taken to Phillip Island. McNally (1957) considered that the vegetation was typical of other similar coastal islands: a comparatively open eastern end with a central and western area covered with scrub and eucalypts including *E. ovata*, *obliqua*, *botroides* and *viminalis*. Along the coast tea-tree is thick, and presumably as a result of clearing fires, bracken (? *Pteridium esculentum*) is extensive. In 1954 McNally estimated that the koala population was about 800 to 1,000 but he noted that reduction of timber was being carried out. Such decrease in food supply would lead to an over concentration of koalas which would reduce the remaining food and consequently cause a population decline. Land clearance is continuing and now some 20,000 acres (c.50% of the total area) are used for primary production (J. Seebeck, pers. comm.).

Little is known about the island's flora and fauna but potoroos (*Potorous tridactylus*) and the native rats (*Rattus fuscipes* and *R. lutreolus*) have all been recorded for the Mount Wellington Reserve (131 acres) as have the feral cat, rabbit and house mouse and sambar deer (*Cervus unicolor*) (J. Seebeck, pers. comm.) It is notable that the island apparently lacks echidnas (*Tachyglossus aculeatus*), possums, bandicoots *Antechinus* and *Sminthopsis* spp., wallabies and platypus (*Ornithorhynchus anatinus*) even though these have all been recorded around the perimeter of Westernport Bay.

Clump Lagoon Water Reserve (54 acres) provides some habitat for waterfowl as do various swamps along the northern edge (particularly Decoy and Bullock Swamps) and the extensive mud flats and shoals along the western and northern shores. The short-tailed shearwater (*Puffinus tenuirostris*) has recently been recorded as breeding on the Tortoise Head region (R. West, pers. comm.).

French Island habitats have suffered, and will continue so to do, from the increasing land alienation. It seems likely that fires in the past contributed to wildlife destruction and as commercial facilities expand in the Westernport area, clearing will accelerate, with a consequent reduction of flora and fauna.

4. PHILLIP ISLAND 38°15'S. 145°15'E.

Phillip Island, of 24,320 acres (c.10,000 hectares), lies to the south of French Island across the Bass Strait side of Westernport Bay. The island is separated from the Victorian mainland by the Western and Eastern Passages, about five miles, and one quarter of a mile wide, respectively. The crescent-shaped island is approximately 12 miles long and almost five miles wide. The land

is generally low, undulating and its highest point, 358 ft (109.2m), is on Cape Woolamai within the Fisheries and Wildlife Reserve. Patton (in Gliddon, 1963) considered that the island had probably not been heavily timbered originally, but was open grassland interspersed with manna, blue and swamp gums, and with fairly plentiful stands of wattle. Large saltmarshes occur, particularly along the northern edge, and these become isolated mangrove swamps in places. Freshwater swamps of tea-tree and reeds are common.

D'Urville, commander of the *Astrolabe*, recorded sealers along the western coast in 1826 (Warneke, 1968), and Haydon (1846) confirmed that settlement of part of the island had begun prior to 1842 when the McHaffie brothers began leasing the island (Gliddon, 1963). Later in 1869 and 1870, the island was opened for selection (Melbourne *Argus* November 3, 1869) and parish plans show that 53.3% of the total island area was sold between 1869 and 1889 (Norman and Gottsch, 1969).

Norman and Gottsch (loc. cit.), in reviewing the status of the colonies of *P. tenuirostris* (locally known as the mutton bird), gave a short account of man's activities on the island. Europeans were responsible for extensive clearing, the introduction of stock and the release of alien mammals. Rabbits were introduced about 1860, fallow (?) deer 1867, and the fox about 1908 (Gliddon, 1963). Much of this activity affected the island's wildlife.

The total breeding area occupied by muttonbirds was estimated at 620 acres by Sutton (1933) but in 1967, Norman and Gottsch (loc. cit.) reported that the area had decreased to 310 acres, with several factors aiding in the reduction. Not only did grazing and trampling by stock, and frequent burning of vegetation assist in the formation of mobile sand drifts which swamped colonies (Campbell, 1928) but the widespread practice of 'birding' (taking of eggs, adults and young) reduced numbers (Campbell and Campbell, 1913). Legislation was introduced to remove destructive factors. All birding was prohibited, 1924, and reserves were established at Forrest Caves, Swan Lake, and more recently on Cape Woolamai. Today stock, mobile sand and extensive birding are of no importance though foxes take a small percentage of muttonbirds. However it is readily apparent that the major threat to the muttonbirds and to wildlife generally is the increasing real estate development with concomitant increases in human disturbance and the occurrence of fires.

Fires present a major problem to the reducing stands of *Eucalyptus viminalis* and the koalas which they support. Reserves set aside for wildlife

on the island include Cape Woolamai (320 acres), water reserves (c.500 acres), and 623 acres primarily for the protection of koalas. Waterfowl habitat is reserved in the 330 acres of Rhyll Swamp where ibises (*Threskiornis molucca* and *T. spinicollis*), teal (*Anas gibberifrons* and *A. castanea*) and other duck breed. The attraction for tourists of penguins (*Eudyptula minor*) has been recognized in the provision of 10 acres of reserve at Summerland Beach.

5. SEAL ROCKS 38°02'S. 145°06'E.

Two small basaltic rocks (seven acres) lying off the south-western corner of Phillip Island make up Seal Rocks, which support an extensive population of the fur seal (*Arctocephalus doriferus*). Lee (1915) recorded sealers working the area in 1801, and in 1813 some 922 seals were killed there in a few days (Warncke, 1968). The seal population had been reduced to c.100 by 1860 (Warneke, loc. cit.) and the Rocks were declared a sanctuary in 1882: the species became protected in 1890. In 1947 this protection was lifted with an open season, and about 700 seals were killed, since they were thought to be competing with commercial fishermen for fish and also damaging nets. At present an extensive research programme on the biology of the seals is being conducted by members of the Fisheries and Wildlife Department (Warneke, 1966, 1968).

6. SHALLOW INLET ISLANDS 37°50'S. 146°10'E.

Two small, tussock-covered islands are found within Shallow Inlet: St. Margaret's Island, long, low and crescent-shaped, and McCrae Islet (Ports and Harbours, 1959). These areas are used by Cape Barren geese (*Cereopsis novae-hollandiae*) and numerous seabirds, as roosting areas.

7. SHELLBACK ISLAND 38°58'S. 146°12'E.

The first of the fifteen islands off Wilsons Promontory. These islands have edaphic similarities, with a bedrock of grey, porphyritic granite and derived soils of a coarse-grained sand with varying amounts of organic material incorporated (Gillham, 1961).

Shellback Island rises to 357 ft (108.8 m) and was reputedly well-known for its abundance of Cape Barren geese (Ports and Harbours, 1959) though Dorward (1967) recorded only five pairs on the 80 acre island. Hope (1969) stated that the island flora was dominated by tussock and that no native mammals had been observed.

(According to Ports and Harbours, 1959 it was this island, and not the Glennies, from which Bass ferried marooned convicts to the Promontory mainland).

8. NORMAN ISLAND 39°02'S. 146°12'E.

Norman Island lies about two miles off Wilsons Promontory, rises to 315 ft (96 m) and is some three-quarters of a mile in length. Dorward (1967) considered that the 100 acre island carried approximately five pairs of Cape Barren geese. Hope (1969) records no native mammals from the island.

9. BIG (GREAT) GLENNIE ISLAND 39°06'S. 146°14'E.

The largest of the four islands in the Glennie Group, Great Glennie is about four miles to the west of Wilsons Promontory. It is saddle-shaped, approximately two miles long, and rises to a peak of 455 ft (138.7 m) towards the southern tip (Ports and Harbours, 1959). The four islands of the Group were declared a sanctuary in 1910, and together with Norman and Shellback Islands, became part of the Wilsons Promontory National Park in 1916.

Norman (1967) recorded extensive *Poa* tussock on the northern end of Great Glennie, and to the south, an extensive *Casuarina* forest which also included a variety of smaller scrub species such as *Acacia*. *Poa* tussock is present between the *Casuarina* and in open exposed areas, where perhaps, because of wind and salt spray, scrub species have not invaded after fires. The island supports numerous Cape Barren geese, some of which breed in the tussock (Dorward and Pizzey, 1965). Dorward and Pizzey (loc. cit.) observed 23 birds together with an additional nine pairs, and concluded that during the April-December period, the island was an important breeding ground. Dorward (1967) later thought that the island's 300 acres supported approximately 30 breeding pairs but noted that the island was an anchorage for fishing boats so that predation may have reduced breeding productivity. Earlier Dorward and Pizzey (1965) had recorded the shooting of geese and the removal of young.

The island carries also very extensive colonies of muttonbirds and penguins, has a resident population of olive whistlers (*Pachycephala olivacea*) and the sea eagle (*Haliaeetus leucogaster*) breeds there. Other passerines occur during migratory periods.

Hope (1969) recorded the Marsupial Mouse (*Antechinus minimus*) and *Rattus fuscipes* from the island, the latter (Norman, unpublished data) occasionally reaching high populations.

Here, as on other Promontory islands, fishermen are known to take Cape Barren geese, to collect muttonbirds and to remove penguins for use as cray-pot bait. Enforcement of the various protection laws in this area seems difficult, since

even casual fishermen nowadays have fast boats and can move quickly, but Dorward and Pizzey (1964) suggested aerial and or sea-going patrols which could operate on a non-regular basis and act in conjunction with the local enforcement.

10. DANNEVIG ISLAND 39°06'S. 146°14'E.

Dannevig Island lies close to and south of Great Glennie, is about one half a mile long and 900 ft wide, and reaches a height of 251 ft (76.5 m) (Ports and Harbours, 1959). The area is approximately 80 acres, but the west coast is bare granite and almost devoid of vegetation except for an occasional *Salicornia australis*. *Poa poiformis* tussocks and patches of *Correa alba* are present on the eastern slopes (Gillham, 1961).

Gillham (loc. cit.) found some 2,000-3,000 muttonbird burrows, several hundred penguin burrows and burrows of the diving petrel (*Pelecanoides urinatrix*) on this island. She considered that grazing by Cape Barren geese was of greater ecological importance than grazing by rabbits. But some years later Dorward (1967) recorded only three pairs of geese.

Hope (1969) stated that no native mammals had been recorded for Dannevig, Citadel or Mc-Hugh Islands.

11. CITADEL ISLAND 39°07'S. 146°14'E.

This 70 acre granite island, which rises to a flat summit of 385 ft (117.4m) is now almost devoid of soil except for small amounts of granite shingle and 'organic dust' (Gillham, 1961). Vegetation is lacking on the south and west slopes and only on the eastern side does it form more than five per cent cover. *Senecio lautus* is the most abundant species, and scrub species *Correa alba* and *Leptospermum laevigatum* are occasionally present. But altogether only seven species of flowering plants, and two ferns, have been recorded (Gillham, 1960). Gillham (1961) thought that the rabbits present were responsible for the reduction of vegetation. These were placed on the island when the lighthouse was being established in 1913 (Norman, 1970).

Numerous penguins nest in rock crevices but the lack of soil prohibits nesting by muttonbirds (Gillham, 1961). Whilst Cape Barren geese use the island there is now no breeding, though photographic evidence shows that it once occurred there (Dorward, 1967).

12. McHUGH ISLAND 39°07'S. 146°14'E.

The smallest island in the Glennie Group, Mc-Hugh Island, rises to 215 ft (65.2 m) (Ports and Harbours, 1959), and occupies 25-30 acres (Gillham, 1961). Most of the island is covered by *Poa poiformis* tussock while *Correa alba*, *Leptosper-*

mum laevigatum and *Olearia phlogopappa* represent the scrub flora in the 18 species recorded for the island. Muttonbirds burrow extensively and nests of penguins and diving petrels have been found (Gillham, loc. cit). Dorward (1967) recorded only one pair of Cape Barren geese.

13. SKULL (CLEFT) ROCK 39°09'S. 146°18'E.

The large, round, sheer granite monolith known as Skull Rock lies one and one half miles from Anser Island, is 371 ft (113.4 m) high (Ports and Harbours, 1959) and has a few tussocks on the summit (Dorward, 1967).

14. KANOWNA ISLAND 39°10'S. 146°18'E.

The middle island in the Anser Group, Kanowna, is one half mile long and about 600 ft wide and reaches a height of 312 ft (95.1 m) (Ports and Harbours, 1959).

Dorward and Pizzey (1965) recorded three pairs of Cape Barren geese and later Dorward (1967) considered that 15 pairs were present on the 100 acre island. Dorward and Pizzey (1964) recorded and photographed approximately 300 fur seals on the island; of a sample of 53, six were full-grown bulls, 17 cows or half-grown young, and 30 were last season's young.

15. ANSER ISLAND 39°09'S. 146°18'E.

The largest of the three islands making up the Anser Group (named apparently from the numbers of geese inhabiting the area), Anser Island is 498 ft (151.8 m) high, a mile long and about a quarter-mile wide. The island lies almost two miles off the southwestern point of Wilsons Promontory (Ports and Harbours, 1959).

Dorward (1967) recorded approximately 20 pairs of Cape Barren geese on the 200 acre island which Hope (1969) stated had a heathy vegetation. Hope recorded no native mammals for the Anser Group which was included in the Promontory National Park in 1916.

16. WATTLE ISLAND 39°08'S. 146°23'E.

Dorward (1967) recorded three pairs of Cape Barren geese on this 70 acre island.

17. RAG ISLAND 39°09'S. 146°19'E.

This is the first small island in the Seal or Direction Group (named by Stokes, 1846). The Group consists of four islands and three rocks all lying in a northwesterly direction about seven miles to the south east of Rabbit Island.

Rag Island is about one mile from Notch Island; it reaches a height of 94 ft (28.7 m) (Ports and Harbours, 1959), and Dorward (1967) recorded three pairs of Cape Barren geese on the 40 acres.

18. CLIFFY ISLAND 38°57'S. 146°42'E.

Cliffy Island, lying 12 miles off Wilsons Promontory, is granite rising to 144 ft (43.9 m) and is approximately 400 yards wide and 300 yards long (Ports and Harbours, 1959). The island has a lighthouse which was established in 1884.

Gillham (1961) recorded 39 plant species from the island but noted that only about three acres around the summit carried any depth of soil: most of the area was barren granite. The alien content of the flora was high (45%) according to Gillham (1960). Hope and Thomson (1971) found major communities of *Disphyma australe* and *Poa poiformis* with minor communities of *Salicornia quinqueflora* and *Senecio lautus*. They recorded a total of 41 vascular species.

Gillham (1961) recorded a small muttonbird population, penguins, and about 100 pairs of the silver gull (*Larus novae-hollandiae*) also breed there. Dorward (1967) did not record Cape Barren geese.

19. NOTCH ISLAND 38°57'S. 146°39'E.

Lying one mile off Seal Island, Notch rises to 123 ft (37.5 m) and is about 600 yards long by 400 yards wide (Ports and Harbours, 1959). Dorward (1967) recorded three pairs of Cape Barren geese on the island.

20. SEAL ISLAND 38°56'S. 146°37'E.

Rising to 154 ft (49.9 m) Seal Island is about 800 yards long, 400 yards wide; coarse tussock covers most of the surface which is burrowed by muttonbirds and penguins (Ports and Harbours, 1959). Goats were liberated there in 1884 as a food source for the lighthouse attendants from Cliffy Island (Ports and Harbours, 1959).

Dorward (1967), noting that the vicinity is a fishing place, found only four pairs of geese on the 50 acres.

21. RABBIT ISLAND 38°55'S. 146°31'E.

Rabbit Island lies about three-quarters of a mile from the east coast of the Promontory and rises to 192 ft (58.5 m), occupying about 80 acres (Ports and Harbours, 1959). Norman (1967) described its physical structure in detail and listed 35 vascular plants recorded from this island to 1965, compared with Gillham's (1961) list of 24. Gillham (1961, 1962) attributed the comparative paucity of the flora to the grazing pressure exerted by rabbits, which was accompanied by drought and bird action. Since Norman's (1967) report a further 11 species have been collected from the island, making a total of 46, which included nine alien species (Norman, 1970).

Rabbits were released on this island in 1836 (Stokes, 1846) and since then a sand blow has developed across the island's central region. In May 1965 *Poa poiformis* tussock dominated the whole island but *Senecio lautus* formed an extensive belt bordering the sand blow. A few *Correa alba* shrubs were present and a small stand of *Acacia longifolia* occupied a region near the summit (Norman 1967). Since then the whole aspect of the island has changed with the presumed elimination of the rabbit population, both by myxomatosis and '1080' poison. Rapid and very extensive regeneration has taken place, particularly of *P. poiformis*, and widespread seeding of *Acacia longifolia* and *Olearia axillaris* has taken place with the complete disappearance of the sand blow. Muttonbird rookeries, once in the sand blow area, have expanded along with the vegetation. It has been suggested that in the absence of rabbits the vegetation will return to a scrub-dominated interior and a coastal belt of *P. poiformis* with perhaps an eventual decrease in muttonbird rookeries (Norman 1970). Apart from the very extensive muttonbird breeding colonies, penguins are fairly widespread, but Cape Barren geese are unknown. Little falcons (*Falco longipennis*) are thought to nest in the cliffs, and the island is frequented by Bass Strait transit migrants (*Zosterops lateralis*, etc.). No native land mammals have been found. The island was included in the Promontory National Park in 1916.

22. GRANITE ISLAND 38°48'S. 146°25'E.

Corner Inlet has three granite islands in the western sector, and also two fairly extensive mangrove (*Avicennia marina*) islands, both of which are low-lying mud and silt flats used extensively by waders and other waterfowl.

Reaching 100 ft (30.5 m) in height, Granite Island lies on the northern bank of the Benison Channel in Corner Inlet, and is about 300 ft wide and 500 ft long. The island is generally bare of scrub, but has extensive tussock which supports a small muttonbird colony (Ports and Harbours, 1959).

Gillham (1961) considered that the three and one-half acre island was the least sheltered of the Inlet islands which she examined. *Poa poiformis* dominated the island and one clump of *Acacia longifolia* was found; the 16 plant species recorded included four aliens (Gillham, 1960, 1961). The island is a nesting place for silver gulls and for black-faced cormorants (*Phalacrocorax fuscescens*).

All Corner Inlet islands have been within the bounds of the Wilsons Promontory National Park since 1916.

23. BENISON ISLAND 38°41'S. 146°22'E.

Benison Island is in the southern part of Corner Inlet, occupies about 19 acres and reaches a height of 150 ft (45.7 m) (Ports and Harbours, 1959). The centre, and eastern side of the island are covered by scrub dominated by *Melaleuca ericifolia* with occasional *Banksia integrifolia*; *Acacia melanoxylon* was also amongst the 59 species recorded by Gillham (1961, 1962). Extensive muttonbird colonies are found, mainly on the western side of the island within the *Poa* tussock.

The island is connected with the Promontory mainland by a low sand-bar which is exposed around low water (Ports and Harbour, 1959). This has enabled foxes (*Vulpes vulpes*) to cross onto the island from the Promontory. Predation of the muttonbirds by foxes is quite extensive and has been studied recently by Norman (1969).

Sea eagles (*Haliaeetus leucogaster*) hunt over the island which has a small resident population of olive whistlers. The island is used as a feeding ground by crows, which eat corpses left by foxes and scavenge along the shoreline.

24. DOUGHBOY ISLAND 38°46'S. 146°18'E.

A granite mass, unexposed when compared with other Corner Inlet islands, Doughboy reaches 80 ft (24.4 m) in height, lies on the southern bank of Doughboy Channel and occupies 10 acres (Ports and Harbours, 1959; Gillham, 1961). The island has the distinction of being the only Promontory island with botanical references pre-dating those of Gillham (1968). Kershaw et al. (1913) visited the area and recorded 50 plant species, six (12%) being aliens, and Gillham (1960) listed 70 species, of which 26 (30%) were aliens. Extensive *Melaleuca ericifolia* occurred on the shallower soil, a large *Eucalyptus viminalis* stand was present on the summit, and frequent scrub species occurred throughout the vegetation. This had been considerably modified since the days when a small hut was built (Kershaw et al., loc. cit.).

This island and the others within Corner Inlet, suffer considerably from the activity of illegal muttonbirding, though there have been several convictions for this in recent years. Fires and minor clearing operations, generally initiated by fishermen, give some cause for alarm.

25. BIG SNAKE (LATROBE) ISLAND 38°56'S. 146°33'E.

Big Snake Island, and others on the eastern extremities of Corner Inlet, have recently (1964) been included in an extensive State Wildlife Re-

serve. The Nooramunga Reserve of approximately 24,600 acres is composed of all inlets, islands, banks and shoals along the coast (apart from Sunday Island which is operated under a separate agreement). These islands are all subject to considerable erosion, and changes of shoreline are frequent (Ports and Harbours, 1959).

Big Snake, a low-lying island which forms the coast between Corner Inlet and Port Albert, has a tall-timbered interior, mainly of 'honeysuckle' (*Bauksia serrata*) and is well grassed (Ports and Harbours, 1959). Taylor (1969) estimated the island's area as being 11,500 acres.

Taylor (loc. cit.) mentioned the introduction of hog deer (*Axis (=Cervinus) porcinus*) into the area in 1866, from India or Ceylon. These have apparently little effect on native herbivores and Taylor stressed the importance of this population as the only isolated one outside the native range of the species. At present live stock is allowed on the island on agistment between late autumn and early spring, though numbers are limited to 1,000 head of cattle.

The island has, in the past, had populations of echidnas, swamp wallabies (*Wallabia bicolor*), grey kangaroos (*Macropus major*), and possums, though none of these are now present (P. Taylor, pers. comm.). *Rattus fuscipes* has been recorded, also foxes and a few rabbits. Koalas were introduced in 1945 and 1955 but fires are thought to have reduced their numbers, since few were seen in late 1961. However koalas were released there in 1963.

Fires, perhaps purposely lit, burnt through some 3,000 acres in 1966 and destroyed much of the scrub. Whilst this may have affected the small wallaby population, it appears that light burns of the vegetation are beneficial to both deer and kangaroos. However on such an island total destruction of habitat by fire is not unlikely.

26. LITTLE SNAKE ISLAND 38°47'S. 146°30'E.

Taylor (1969) gave the area of this island as 1,500 acres; it is low-lying, with a mangrove swamp along the western coast (Ports and Harbours, 1959). Occasional deer, kangaroos, and emus (*Dromaius novae-hollandiae*) move into the area from the mainland at low tides, and also cross to other local islands at low water when many islands are joined by mud flats (P. Taylor, pers. comm.). The island was grazed in the past and it was considered that the large grey kangaroo population competed with stock. Accordingly 400 kangaroos were shot between 1919 and 1934, 250 in 1959, and 347 in 1960. Koalas were released on the island in November 1967 (information from Fisheries and Wildlife files).

27. SUNDAY ISLAND 38°42'S. 146°38'E.

Encircled by Snake, Midge and Main North Channels, Sunday Island lies between Big Snake Island and Port Albert. It is about five miles in length, about two miles wide and occupies about 4,000 acres. The whole island is openly timbered with *Banksia serrata* and *E. viminalis*, apart from the Drum or Drum Island (an island only at low water) (Ports and Harbours, 1959; Turner, Carr and Bird, 1962). Drum Island is openly wooded with a stand of manuka (*Leptospermum* sp.) (Ports and Harbours, 1959).

Sunday Island has four distinct land types: dune ridges, sandy terraces, salt swamps and freshwater swamps. The older dune ridges along the centre are almost encircled by swamps and salt marshes. Terraces on landward sides of ridges are presumed to be old sand flats (Turner et al., 1962) and the vegetation shows five zones indicating five stages of succession.

This island has been used as a grazing run from about 1860 and a homestead was occupied between 1918 and 1938. Cattle were first grazed but later (presumably after clearing and improvement) up to 2,200 sheep were run (Turner et al., 1962). Goats were introduced in 1928 and were still present in 1947 (and perhaps in 1965, P. Taylor, pers. comm.). Most grazing was apparently in lower regions as Turner et al. (loc. cit.) considered that the sand ridges and hollows appeared to be in an ungrazed state, and recorded 254 vascular species, including 32 (12.7%) aliens. Occasional fires have not seriously damaged stands of trees but have encouraged *Pteridium esculentum* in places. Wallabies and rabbits were once numerous but myxomatosis reduced the rabbits and the wallabies were all killed off by wild dogs by 1950. However occasional grey kangaroos, wallabies and foxes still arrive on the island and *Antechinus (swainsonii ?)* and pygmy possum (*Cercartetus nanus*) have recently been recorded (P. Taylor, pers. comm.).

Sunday Island is now being run as a hog deer management area and is probably the first co-operative project in Australia where attempts at increasing a game species are being made by a private organization. The scheme was further discussed by Cowling (1969), Manning (1969) and Taylor (1969).

28. BIG DOG ISLAND 38°41'S. 146°15'E.

A low-lying island (about five ft high) covered by grass and light timber, which extends about one and a half miles and is three-quarters of a mile wide. The mangrove-fringed island is a cattle run (Ports and Harbours, 1959) on which goats, rabbits and foxes occur (P. Taylor, pers. comm.).

29. LITTLE DOG ISLAND 38°41'S. 146°15'E.

A small island approximately one mile by one quarter of a mile, used as a cattle run (Ports and Harbours, 1959).

30. CLONMEL ISLAND 38°44'S. 146°35'E.

Clonmel Island lies at the southwestern end of the Ninety-Mile Beach and is described in detail by Turner et al. (1962). The island's embryonic dune system is backed by high foredunes, and transition to dune scrub occurs. In the latter area *Acacia longifolia*, *Olearia axillaris* and *Helichrysum gunnii* are dominant, attaining heights of up to 25 ft.

31. MIDDLE GROUND GROUP 38°43'S. 146°16'E.

This listing of islands along the West Gippsland coast is terminated with mention of four islets making up the Middle Ground Group. All are small, less than half a mile long and a quarter of a mile wide, and all are low-lying. Bullock Horn Islet is samphire-covered (? *Disphyma*). Inner and North Mangrove Islets are mangrove-dominated and Mary Islet has both mangrove and scrub (Ports and Harbours, 1959).

There are several other small areas of mangrove-covered mud bank in this region of Corner Inlet. All are submerged at high tides and all are subject to frequent, severe erosion.

DISCUSSION

This review of the islands of the West Gippsland coast has shown that there is a lack of information concerning almost all aspects of their ecology. On the islands for which information is available, modification of habitat has taken place and is still continuing. These facts become more pertinent when it is realised that the island habitats are not represented elsewhere. Their uniqueness allows measurement of short-term evolutionary processes in established plant communities and in successful animal populations. Further, if the disturbed habitats, modification patterns have been different from one island to the next, and the interaction of man with this particular environment may be measured against varying historical backgrounds. The interactions of the introduced mammals, native flora and native fauna may also be studied in isolation, and in areas where variations in complexity occurred or still occur.

In this region as elsewhere man has been the main factor causing ecological distress. Man has influenced island faunas directly both by becoming an alien predator and by destroying or severely modifying habitats by clearing and firing vegeta-

tion, and by deliberate introduction of alien herbivores. Stock has been held responsible for vegetational modification by selective grazing or by trampling, and perhaps also for soil modification (Bharucha and Shankaranarayan, 1958). Stock may also destroy burrows of ground-nesting species such as the muttonbird (Mattingley, 1938) or even cause soil consolidation to the extent that burrowing becomes impossible (Littler, 1910). Thus sheep grazing has been held responsible for local reductions in muttonbird numbers (Campbell, 1900; Serventy, 1958), though Norman (1969) concluded that sheep were not contributing to failure of breeding seasons, nor were they preventing expansion of existing nesting areas.

Predation of the Cape Barren goose is still prevalent in Bass Strait waters and on islands in the West Gippsland region (Dorward, 1967). Dorward and Pizzey (1965) mentioned the removal of young geese (to be eaten later, when larger grown) from the Glennie Group which, with other islands off the Promontory, make up breeding habitat for 5% of the world's Cape Barren goose population (Dorward, 1967). Man also removes a part of the annual production of muttonbirds bred on Corner Inlet and Promontory islands and from the Phillip Island colonics. Penguins are similarly taken, though not as food but as bait for crayfish pots. The fur seal which breeds at four sites in Victoria, including Seal Rocks, is protected, but nonetheless the species is still persecuted.

Clearing of vegetation, by fire or by other means, is a seemingly more indirect but more positive method of ensuring that habitats, and

thus the faunas which they support, are reduced. The severity of such habitat removal can determine whether a population becomes extinct or merely reduced to a locally insignificant level. Norman and Gottsch (1969) showed that whilst muttonbird colonies on Phillip Island had contracted by fifty per cent during the past 40 years, clearing was still taking place. Fires on these Phillip Island breeding areas have caused destruction to both breeding adults and to their young in the past few breeding seasons. In the same area clearing fires have reduced food sources for the koala and have occasionally destroyed the koalas themselves. Elsewhere on Phillip Island clearing of wildlife habitat continues apace with the eventual spread of real estate development. Scrub removal and associated land improvement of grassland has resulted in many areas being rendered useless as faunal habitat and in the reduction of entire plant communities. Improvement of grazing areas often involves a reduction of native herbivores which may be competing for food in an environment increasingly unfavourable to them (see also Marlow, 1958).

Alien plant species have often been associated with land clearance and with the introduction of stock. Table 1 shows the extent of alien content on those islands which have been studied, and the table also allows comparison with the species recorded for Rodondo Island (seven miles to the south of the Promontory) which has not received any apparent disturbance from man (Bechervaise, 1947; Willis 1947). Within disturbed island habitats, aliens may be more favoured than native plant species (Gillham, 1960).

TABLE 1
Disturbance of habitat on selected West Gippsland islands.
Alien plant species are recorded as a percentage of all plants recorded;
known human activity, the past or present occurrence of stock and other
alien mammals is noted (see text for references).

Island	Plants Recorded			Human Activity			Alien Mammals		
	Total	Number Alien	Percent Alien	Clearing	Fires	Stock*	Rabbit	Fox	Others*
Quail				?	+	(+)	+	(+)	
French				+	+	e, s	+	?	d, fc, m
Phillip				+	+	e, g, h, s	+	+	fc, d, m, r
Citadel	7	nil	nil				+		
Dannevig	20	5	25						
Cliffy	41	19	45						
Rabbit	46	9	19.5	?	+		+		
Benison	59	10	17	?	?			+	
Doughboy	78	19	24	?	?		(+)		
Big Snake				+	+	e	?	+	d
Sunday	254	32	12.6	+	+	e, s	+	+	d, dg, fc, g
Rodondo	40	2	5	nil	nil	nil	nil	nil	nil

* Abbreviations used are + = present, (+) = in past, ? = doubtful, e = cattle, d = deer, dg = dog, fc = feral cat, g = goat, h = horses, m = house mouse, r = rats, s = sheep.

Rabbits were introduced onto several Bass Strait islands as a food source either (Rabbit Island) for potentially shipwrecked persons or (Citadel Island) for provisions for lighthouse attendants (Norman, 1969). For the latter purpose, goats were also placed on Seal Island (Hope and Thomson, 1971). The effects of these releases have been dramatic. Whereas Citadel had an extensive plant cover in the past and one which supported Cape Barren geese (Dorward, 1967), Gillham (1961) could find only seven vascular species on the almost barren island where geese and muttonbirds no longer bred. On Rabbit Island both clearance and the rabbit are thought to have caused widespread erosion which involved destruction of 16 acres of muttonbird colonies and the depression of all seedling growth, including that of scrub species (Norman, 1970). Doubtless rabbits also played a part in the mobilization of sand dunes which swamped breeding areas of muttonbirds on Phillip Island (Campbell, 1928).

Foxes appeared on Phillip Island in about 1908 (Gliddon, 1963) and were soon recorded as predators of muttonbirds (Gabriel, 1919). Since then fox predation has been recorded at all of the 15 Phillip Island nesting colonies (Norman and Gottsch, 1969); this predation removed approximately 1.6% of marked birds in a study area on Cape Woolamai (Norman and Gottsch, 1967). Learmonth (1965) considered that the fox was preventing breeding on the Victorian mainland and indeed it appears that fox predation is causing a decline in breeding adults on Benison Island (Norman, 1969).

Deer were widely released in Victoria and some appeared on Phillip Island in 1869 (Gliddon, 1963) and on Sunday Island in 1866 (Taylor, 1969). However on neither are they numerous and it is doubtful whether competition with marsupials is important.

It is clear that several factors influence the continuance of the island habitats; all factors concern man and his activities. If the various species of birds, discussed above, are worthy of conservation (and existing laws suggests that they are) then equally worthy of conservation are the habitats in which they occur. Even though the West Gippsland islands have 29,445 acres¹ reserved in some form for flora and fauna protection, the majority of islands are unpoliced. These islands are widespread and in regions which are difficult to patrol. Not only is a larger, more mobile enforcement body required but, more important,

¹ Made up by 2,477 acres of State Faunal Reserves, 1780 acres retained under various reserve categories, some islands (totalling 588 acres) off the Wilsons Promontory National Park, 24,600 acres of the Nooramunga State Faunal Reserve.

there is an acute need for a change in attitude towards wildlife and wildlife habitats generally. For some species, such as the Cape Barren goose and the muttonbird, and for some habitats, much detailed literature exists. However these islands contain many other components for which data are non-existent. Taylor (1968), in discussing related problems affecting islands off the New Zealand coast, recognised two priorities. Firstly that all islands recognised to be in a primitive (undisturbed) state were to be protected, and secondly, that a control of or an elimination of alien mammals on other unstable, actively degrading islands was to be undertaken. Clearly this is an adequate assessment of the present situation on the West Gippsland islands, and for both priorities immediate research is obligatory.

SUMMARY

Ecological information concerning the West Gippsland islands is reviewed. It is noted that for few species and for few habitats is information available. Problems affecting the islands' wildlife and habitats are recognised. Such problems include the whole range of man's activities, from land clearance for pastoral or real estate development to the introduction of alien mammals. Attention is drawn to the current reduction of wildlife and wildlife habitat and it is concluded that habitat preservation is as important as species protection. Research towards this goal is advocated.

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